

WHAT IS CLAIMED IS:

- 1           1. A delivery system, comprising:
  - 2           a frame;
  - 3           a plurality of hoppers attachable to the frame in a vertically spaced apart arrangement, wherein the hoppers are each configured to hold a plurality of sheet-like materials;
  - 6           at least one upper belt movably coupled to the frame, wherein the belt is configured to move the sheet-like materials downward from the hoppers;
  - 8           at least one contact roller disposed below each hopper;
  - 9           at least one suction apparatus that is associated with each hopper; and
  - 10          a moving system that is configured to move the suction apparatus toward and away from the hopper to grasp and remove one of the sheet-like materials from the hopper, and to move the removed sheet-like material downward until grabbed by the contact roller.
- 1           2. A system as in claim 1, wherein the moving system comprises a cylinder to move the suction apparatus toward and away from the hopper, and a linkage arrangement that is pivotally coupled to the frame member to move the suction apparatus in an up and down motion.
- 1           3. A system as in claim 1, further comprising a biasing roller that is spring biased against the contact roller.
- 1           4. A system as in claim 1, wherein the suction apparatus comprises a length of tubing and a suction cup coupled to the tubing.
- 1           5. A system as in claim 1, wherein upper belt is spaced apart from another upper belt, wherein the suction apparatus is movable beyond the two upper belts, and further comprising two additional suction apparatus that located on opposite sides of the two upper belts.
- 1           6. A system as in claim 1, wherein the suction apparatus is coupled to a block, and further comprising a guide that is pivotally coupled to the frame, wherein the guide includes a roller that moves behind the block when the suction apparatus is moved downward to guide the suction apparatus in its downward path.

1                   7.       A system as in claim 2, further comprising a rod coupled to each  
2 linkage arrangement, wherein the rod is movable up and down to simultaneously move each  
3 linkage arrangement.

1                   8.       A system as in claim 1, further comprising an air jet associated with  
2 each hopper, wherein the air jets are arranged to laterally supply air to the sheet-like materials  
3 to facilitate separation of the sheet-like materials.

1                   9.       A system as in claim 1, further comprising a controller that is  
2 configured to operate the moving system.

1                   10.      A system as in claim 1, further comprising at least one lower belt that  
2 is configured to receive sheet-like materials from the upper belt.

1                   11.      A system as in claim 10, further comprising a set of transition belts  
2 between the upper belt and the lower belt.

1                   12.      A system as in claim 1, further comprising a guide that is configured to  
2 hold one of the sheet-like materials to the upper belt as the sheet-like material moves toward  
3 the contact roller.

1                   13.      A system as in claim 10, further comprising a counter that is  
2 configured to count the number of sheet-like materials passing along the lower belt.

1                   14.      A system as in claim 1, further comprising a vacuum transducer that is  
2 adapted to sense the pressure within the suction apparatus to determine whether one of the  
3 sheet-like materials is attached to the suction apparatus.

1                   15.      A system as in claim 10, further comprising a thickness tester that is  
2 configured to determine the number of sheet-like materials stacked on the lower belt.

1                   16.      A delivery system, comprising:  
2                    a frame;  
3                    a plurality of hoppers attachable to the frame in a vertically spaced apart  
4 arrangement, wherein the hoppers are each configured to hold a plurality of sheet-like  
5 materials;

6 at least one upper belt movably coupled to the frame, wherein the belt is  
7 configured to move sheet-like materials downward from the hoppers;  
8 at least one contact roller disposed below each hopper;  
9 at least one suction apparatus that is associated with each hopper, wherein the  
10 suction apparatus is movable toward and away from the hopper to remove the sheet-like  
11 materials from each hopper; and  
12 a guide that is configured to hold one of the sheet-like materials to the upper  
13 belt as the sheet-like material moves toward the contact roller.

1                   17.    A system as in claim 16, wherein the guide comprises a plate and a  
2    roller disposed below the plate.

1            18. A sheet-like material detection system comprising:  
2            a frame;  
3            at least one belt that is configured to move sheet-like materials;  
4            at least one roller disposed over the belt that is configured to roll over a sheet-  
5            like material moved by the belt, wherein the roller is coupled to an axle that is pivotally  
6            coupled to the frame;  
7            an arm that is coupled to the axle;  
8            a potentiometer in contact with the arm, wherein the potentiometer is  
9            configured to produce an electrical signal that is related to the amount of movement of the  
10          arm that is turn is related to the amount of movement of the roller when one or more sheet-  
11          like materials is beneath the roller.

1                           19. A system as in claim 18, further comprising a trigger sensor that is  
2 configured to sense when a sheet-like material is beneath the roller.

1                           20. A system as in claim 19, further comprising a controller that is  
2 configured to receive a signal from the trigger sensor indicating that a sheet-like material is  
3 beneath the roller and to record a signal from the potentiometer up receive of the signal from  
4 the trigger sensor.

1                   21.        A method for moving sheet-like materials, the method comprising:  
2                   coupling a plurality of hoppers to a frame in a vertically spaced apart  
3                   arrangement, wherein the hoppers each hold a plurality of sheet-like materials;

4 moving one of the sheet-like materials from one of the hoppers with a suction  
5 apparatus;  
6 moving the suction apparatus and the sheet-like material downward until the  
7 sheet-like material is grabbed between at least one upper belt that is movably coupled to the  
8 frame and at least one contact roller that is disposed below the hopper; and  
9 moving the sheet-like material downward with the upper belt.

1                   22.     A method as in claim 21, further comprising simultaneously moving  
2 individual sheet-like materials from at least two of the hoppers with separate suction  
3 apparatus.

1                   23.     A method as in claim 22, further comprising simultaneously moving  
2     the suction apparatus downward until each sheet-like material is grabbed between the upper  
3     belt and a contact roller that is associated with each hopper.

1                           24. A method as in claim 23, further comprising retracting the suction  
2 apparatus behind the belt so that the sheet-like materials moving downward do not contact the  
3 suction apparatus.

1                           25. A method as in claim 21, further comprising holding the sheet-like  
2 material to the upper belt with a guide as the sheet-like material moves toward the contact  
3 roller.

1                   26. A method as in claim 22, wherein each suction apparatus is moved  
2 with a cylinder toward and away from the hopper, and wherein each suction apparatus is  
3 moved up and down with a linkage arrangement that is pivotally coupled to the frame  
4 member.

1                   27. A method as in claim 21, further comprising biasing the sheet-like  
2 material against the contact roller with a biasing roller.

1                           28.     A method as in claim 21, wherein the suction apparatus comprises a  
2     length of tubing and a suction cup coupled to the tubing.

3        during downward movement with a roller that moves behind the block when the suction  
4        apparatus is moved downward.

1                30.        A method as in claim 26, wherein a rod is coupled to each linkage  
2        arrangement, wherein the rod is moved up and down to simultaneously move each linkage  
3        arrangement.

1                31.        A method as in claim 21, further comprising supplying a gas stream  
2        laterally into the sheet-like materials to facilitate separation of the sheet-like materials.

1                32.        A method as in claim 21, further comprising a controller that is  
2        configured to operate the moving system.

1                33.        A method as in claim 21, further comprising providing at least one  
2        lower belt that is configured to receive sheet-like materials from the upper belt and a set of  
3        transition belts between the upper belt and the lower belt.

1                34.        A method as in claim 33, further comprising counting the number of  
2        sheet-like materials passing along the lower belt with a counter.

1                35.        A method as in claim 21, further comprising sensing the pressure  
2        within the suction apparatus to determine whether a sheet-like material is attached to the  
3        suction apparatus.

1                36.        A method as in claim 33, further comprising measuring the thickness  
2        of each sheet-like material when on the lower belt to determine if one or more other sheet-  
3        like materials are attached to the sheet-like material.

1                37.        A method for detecting how many sheet-like materials are stacked  
2        together, the method comprising:

3                        moving one or more sheet-like materials along a belt until the sheet-like  
4        material passes beneath a roller, wherein the roller is coupled to an axle that is pivotally  
5        coupled to a frame, and wherein an arm is coupled to the axle; and

6                        detecting the amount of movement of the arm to determine the number of  
7        sheet-like materials beneath the roller.

1                   38.    A method as in claim 37, wherein the detecting step comprises  
2    permitting the arm to move against a potentiometer to produce an electrical signal that is  
3    related to the amount of movement of the arm.

1                   39.    A method as in claim 38, further comprising placing one sheet-like  
2    material between the roller and the belt and calibrating the potentiometer.

1                   40.    A method as in claim 37, further comprising sensing with a sensor  
2    when the sheet-like material is beneath the roller.